



James Ruse Agricultural High School

Theory

Year 11 Preliminary Chemistry Exam 2011

General Instructions

- **Reading Time:** 5 minutes
- **Working Time:** 50 minutes
- Write using black or blue pen
- Board approved calculators may be used
- Write your Student Number at the top of page 9
- A Periodic Table and Data sheet are provided

Total Marks 51

Multiple Choice: 15 marks
Attempt Questions 1-15

Sample: $2 + 4 =$ (A) 2 (B) 6 (C) 8 (D) 9
A ☐ B ☒ C ☐ D ☐

A  B  C  D 

A  B  C  D 

correct (arrow pointing to B)

JRAHS Preliminary Chemistry Theory Exam 2011

Multiple Choice Questions

1. Choose the option that gives the correct examples for the terms in italics.

	Column I	Column II	Column III
	<i>mixture</i>	<i>solute</i>	<i>solvent</i>
(A)	mud slurry	mud	water
(B)	wine	water	ethanol
(C)	1 % sodium chloride in water	sodium chloride	water
(D)	salad dressing	oil	vinegar

To answer questions 2 and 3, consider the following properties of water:

- (i) has a high surface tension
 - (ii) has high heat of vaporisation
 - (iii) expands when frozen
 - (iv) is a polar molecule
 - (v) has a relatively low molar mass
2. Which of the properties contribute most to the ability of water to be an agent of weathering of rocks both as liquid and solid?
- (A) (i) and (v)
 - (B) (i) and (iii) only
 - (C) (ii) and (v) only
 - (D) (iii) and (iv) only
3. Which of the properties of water contribute most to the role of water as a habitat in which temperature extremes are less than terrestrial habitats?
- (A) (i) and (v)
 - (B) (ii) and (iii) only
 - (C) (iv) only
 - (D) (iii) and (v) only

4. Experts recommend the use of hot water for more efficient cleaning of clothes. This efficiency can be related to the effect of temperature on the surface tension and viscosity of water.

Which of the statements correctly describe the effect of an increase in temperature on the intermolecular forces in water.

	<i>Intermolecular forces</i>	<i>viscosity</i>	<i>surface tension</i>
(A)	decreased	decreased	decreased
(B)	decreased	increased	increased
(C)	increased	increased	increased
(D)	increased	decreased	decreased

5. Concentration of substances in mixtures are normally expressed according to the amount of substance in the mixture and whether it is used in commerce, the home or the laboratory.

Choose the units used for expressing the concentrations of the substances listed.

	<i>mercury in oysters</i>	<i>salt in cookies</i>	<i>hydrochloric acid solution for reaction</i>	<i>ethanol in petrol</i>
(A)	ppm	ppm	mg L ⁻¹	percent (v/v)
(B)	mg L ⁻¹	percent (w/v)	mol L ⁻¹	percent (w/v)
(C)	ppm	percent (w/w)	mol L ⁻¹	percent (v/v)
(D)	mg L ⁻¹	percent (v/v)	mol L ⁻¹	percent (v/v)

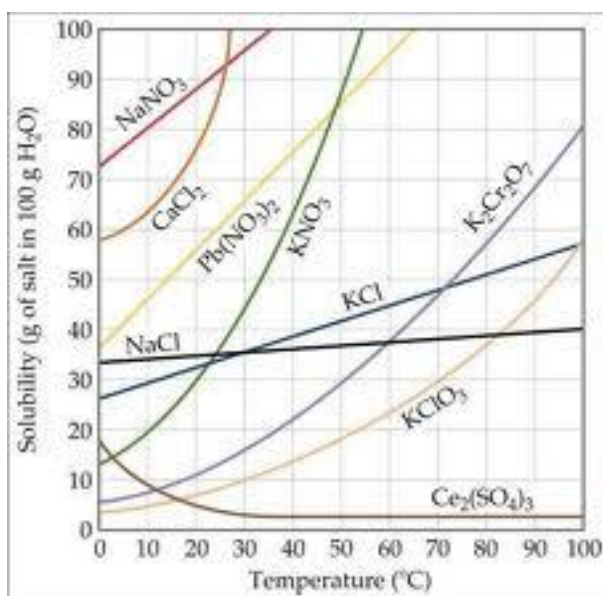
6. The specific heat capacities of various substances are given in the table.

<i>Substance</i>	<i>Specific heat capacity (kJ/kg-K)</i>
acetic acid	2.18
milk	3.93
olive oil	1.97
chloroform	1.05

If exactly 100 g of each liquid is heated in the same container, with the same heating element and stirring equipment, which of the liquids will have the highest temperature after 1.0 minute of heating?

- (A) acetic acid
- (B) milk
- (C) olive oil
- (D) chloroform
7. Which of these factors would decrease the rate of reaction between solid calcium carbonate and a hydrochloric acid solution?
- (A) Increased surface area of the solid.
- (B) Increased temperature.
- (C) Decreased volume of the acid solution.
- (D) Decreased concentration of the acid solution.

8. Consider the solubility curve for various substances shown in the diagram.



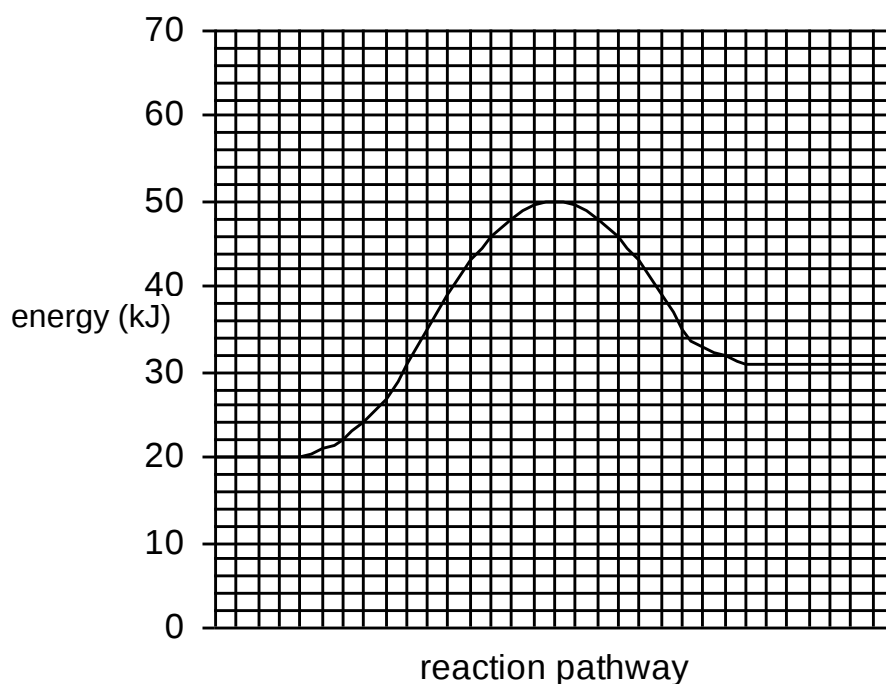
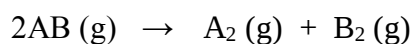
Which of the salts has the highest solubility at 27 °C?

- (A) NaNO₃
- (B) Ce₂(SO₄)₃
- (C) CaCl₂
- (D) NaCl

9. How many oxygen atoms are present in 10.0 g of magnesium nitrate?

- (A) 0.0693
- (B) 2.4×10^{23}
- (C) 4.17×10^{24}
- (D) 8.34×10^{24}

10. The energy pathway for the following reaction is shown in the graph.



What is the enthalpy change for the reaction?

- (A) + 30 kJ
- (B) + 11 kJ
- (C) - 30 kJ
- (D) - 11 kJ
11. What is the best quantity to measure to compare activation energies for hydrocarbon combustion reactions?
- (A) ignition temperatures
- (B) heat changes
- (C) energy released per kilogram of fuel
- (D) number of chemical bonds broken and chemical bonds formed

12. Which of the following equations represents the complete combustion of ethane?
- (A) $\text{C}_2\text{H}_6(\text{g}) + \text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{g})$
- (B) $2\text{C}_2\text{H}_6(\text{g}) + 7\text{O}_2(\text{g}) \rightarrow 4\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{g})$
- (C) $2\text{C}_2\text{H}_6(\text{g}) + 6\text{O}_2(\text{g}) \rightarrow 2\text{CO} + 2\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{g})$
- (D) $2\text{C}_2\text{H}_6(\text{g}) + 9/2\text{O}_2(\text{g}) \rightarrow 2\text{C} + \text{CO} + \text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{g})$
13. Which of the following statements is correct for the dissolution of sodium hydroxide?
- (A) The energy released by bond formation in ion hydration is greater than the energy absorbed by bond breaking and the dissolution is exothermic.
- (B) The energy released by bond formation in ion hydration is greater than the energy absorbed by bond breaking and the dissolution is endothermic.
- (C) The energy released by bond formation in ionisation is greater than the energy absorbed by bond breaking and the dissolution is endothermic.
- (D) The energy released by bond formation in ion hydration is less than the energy absorbed by bond breaking and the dissolution is exothermic
14. Which of the following affects the kinetic energy of particles?
- (A) particle size
- (B) concentration
- (C) temperature
- (D) a catalyst
15. Which of the following occupies the greatest volume at 25°C ?
- (A) one mole of sulfur dioxide gas
- (B) 64.0 g of oxygen gas
- (C) 53 L of nitrogen gas
- (D) 1.8×10^{24} molecules of hydrogen gas

Student No.

Mark

Part A: Answer grid for multiple choice questions

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|-----|-------------------------|-------------------------|-------------------------|-------------------------|
| 1. | A ☐ | B ☐ | C ☐ | D ☐ |
| 2. | A ☐ | B ☐ | C ☐ | D ☐ |
| 3. | A ☐ | B ☐ | C ☐ | D ☐ |
| 4. | A ☐ | B ☐ | C ☐ | D ☐ |
| 5. | A ☐ | B ☐ | C ☐ | D ☐ |
| 6. | A ☐ | B ☐ | C ☐ | D ☐ |
| 7. | A ☐ | B ☐ | C ☐ | D ☐ |
| 8. | A ☐ | B ☐ | C ☐ | D ☐ |
| 9. | A ☐ | B ☐ | C ☐ | D ☐ |
| 10. | A ☐ | B ☐ | C ☐ | D ☐ |
| 11. | A ☐ | B ☐ | C ☐ | D ☐ |
| 12. | A ☐ | B ☐ | C ☐ | D ☐ |
| 13. | A ☐ | B ☐ | C ☐ | D ☐ |
| 14. | A ☐ | B ☐ | C ☐ | D ☐ |
| 15. | A ☐ | B ☐ | C ☐ | D ☐ |

Part B. 36 marks

Attempt Questions 16- 23

Allow about 40 minutes for this part

► Show all relevant working in questions involving calculations.

Question 16. (7 marks)

Consider the three substances ammonia, water and hydrogen sulfide.

- (a) Construct Lewis electron dot structures for the three compounds (3 marks)

ammonia	water	hydrogen sulfide
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- (b) Identify the molecular shape of ammonia (1 mark)

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- (c) Discuss the intermolecular forces that explain the melting and boiling points of the three substances (3 marks)

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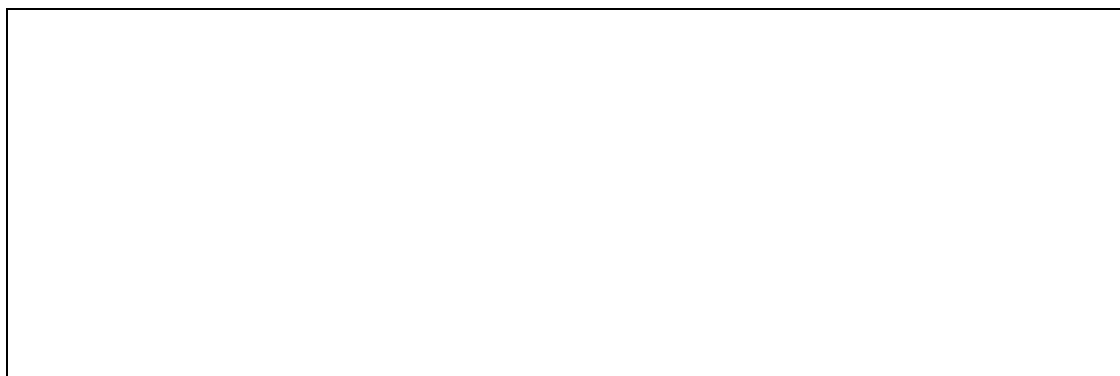
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Question 17 (3 marks)

- (a) Use an ionic equation to show the dissolution of sodium chloride in water forming a saturated solution. (1 mark)

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- (b) Draw a very clear diagram to show how sodium chloride interacts with water resulting in its dissolution (2 marks)



Question 18 (5 marks)

0.534 g of calcium chloride was dissolved in enough water to make a 500.0 mL solution.

- (a) What is the concentration of calcium chloride in the solution

- (i) in ppm? (1 mark)

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- (ii) in mol L⁻¹? (2 marks)

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- (b) What is the concentration of Cl⁻ in % (w/v) (2 marks)

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Question 19 (5 marks)

When 10.0 mL of a 0.02 mol L⁻¹ barium chloride solution is added to 50.0 mL of a 0.02 mol L⁻¹ of silver nitrate solution, a white precipitate is formed.

- (a) Write a net ionic equation for this exothermic reaction. (1 mark)

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- (b) What mass (in grams) of precipitate is formed? (4 marks)

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Question 20 (5 marks)

You performed a first hand investigation to observe the change in reaction rate of a chemical reaction by changing the temperature.

- (a) Outline the procedure used and the results obtained. (3 marks)

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- (b) Identify a risk associated with this procedure and explain the step(s) taken to reduce the risk identified. (2 marks)

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Question 21 (5 marks)

40 mL of propane (C_3H_8) was mixed with 100 mL oxygen and ignited at 200°C . When combustion was complete, it was found that all the oxygen had been used and 20 mL of propane was left.

- (a) Write an equation for this reaction. (1 mark)

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- (b) Calculate the volumes of the gases produced in the final gas mixture. (2 marks)

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- (c) Show that these results are consistent with Gay Lussac's Law of combining volumes. (2 marks)

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Question 22 (3 marks)

Identify an industrial catalyst and describe the role it has in a chemical reaction.

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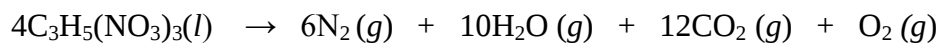
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Question 23 (3 marks)

Nitroglycerine $\text{C}_3\text{H}_5(\text{NO}_3)_3(l)$ is used as an explosive and undergoes the following decomposition reaction.



- (a) Calculate the molar mass of one mole of nitroglycerine. (1 mark)

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- (b) How many moles of gas would be produced by the decomposition of two moles of nitroglycerine at 25°C ? (1 mark)

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- (c) What volume of gas would be released by the decomposition of four moles of nitroglycerine at 25°C ? (1 mark)

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End of Test

Year 11 chemistry 2011 yearly answers

1. Choose the option that gives the correct examples for the terms in italics.

	Column I	Column II	Column III
	<i>mixture</i>	<i>solute</i>	<i>solvent</i>
(A)	mud slurry	mud	water
(B)	wine	water	ethanol
(C)	1 % sodium chloride in water	sodium chloride	water
(D)	salad dressing	oil	vinegar

Outcomes : P13

2. Consider the following properties of water:

- (i) has a high surface tension
- (ii) has high heat of vaporisation
- (iii) expands when frozen
- (iv) is a polar molecule
- (v) has a relatively low molar mass

Which of the properties contribute most to the ability of water to be an agent of weathering of rocks both as liquid and solid?

- (A) (i) and (v)
- (B) (i) and (iii) only
- (C) (ii) and (v) only
- (D) **(iii) and (iv) only**

Outcomes : P4, P13

3. Consider the properties of water listed in question 2.

Which of the properties of water contribute most to the role of water as a habitat in which temperature extremes are less than terrestrial habitats?

- (A) (i) and (v)
- (B) **(ii) and (iii) only**
- (C) (iv) only
- (D) (iii) and (v) only

Outcomes : P4, P13

4. Experts recommend the use of hot water for more efficient cleaning of clothes. This efficiency can be related to the effect of temperature on the surface tension and viscosity of water.

Which of the statements correctly describe the effect of an increase in temperature on the intermolecular forces in water.

	<i>Intermolecular forces</i>	<i>viscosity</i>	<i>surface tension</i>
(A)	decreased	decreased	decreased
(B)	decreased	increased	increased
(C)	increased	increased	increased
(D)	increased	decreased	decreased

Outcomes : P4, P8, P13

5. Concentration of substances in mixtures are normally expressed according to the amounts of substance in the mixture and whether it is used in commerce, the home or the laboratory.

Choose the units used for expressing the concentration of substances listed in the table.

	<i>mercury in oysters</i>	<i>salt in cookies</i>	<i>hydrochloric acid solution for reaction</i>	<i>ethanol in petrol</i>
(A)	ppm	ppm	mg L ⁻¹	percent (v/v)
(B)	mg L ⁻¹	percent (w/v)	mol L ⁻¹	percent (w/v)
(C)	ppm	percent (w/w)	mol L⁻¹	percent (v/v)
(D)	mg L ⁻¹	percent (v/v)	mol L ⁻¹	percent (v/v)

Outcomes : P10, P13, P14

6. The specific heat capacity of various substances are given in the table.

<i>Substance</i>	<i>Specific heat capacity (kJ/kg-K)</i>
acetic acid	2.18
milk	3.93
olive oil	1.97
chloroform	1.05

If exactly 100 g of each liquid is heated, in the same container, with the same heating element and stirring equipment, which of the liquids will have the highest temperature after 1.0 minute of heating?

- (A) acetic acid
- (B) milk
- (C) olive oil
- (D) **chloroform**

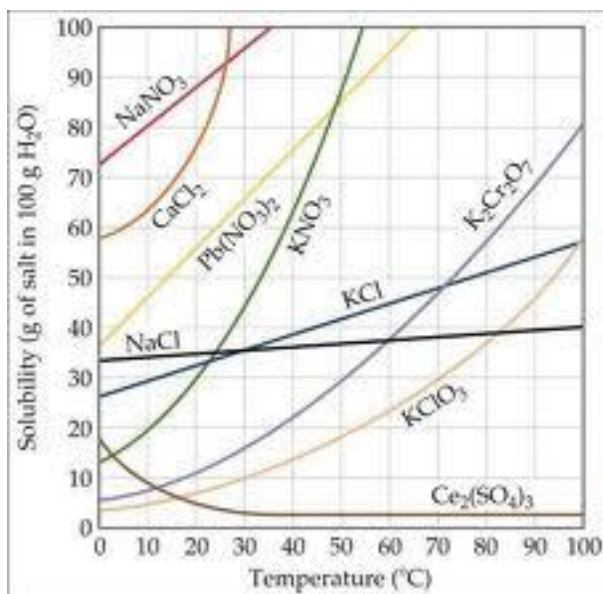
Outcomes : P13, P14

7. Which of these factors would decrease the rate of reaction between a solid calcium carbonate and a hydrochloric acid solution ?

- (A) Increased surface area of the solid.
- (B) Increased temperature.
- (C) Decreased volume of the acid solution.
- (D) **Decreased concentration of the acid solution.**

Outcomes : P8

8. Consider the solubility curve for various substances shown in the diagram.



Which of the salts has the highest solubility at 27 °C?

- (A) NaNO_3
- (B) $\text{Ce}_2(\text{SO}_4)_3$
- (C) **CaCl_2**
- (D) NaCl

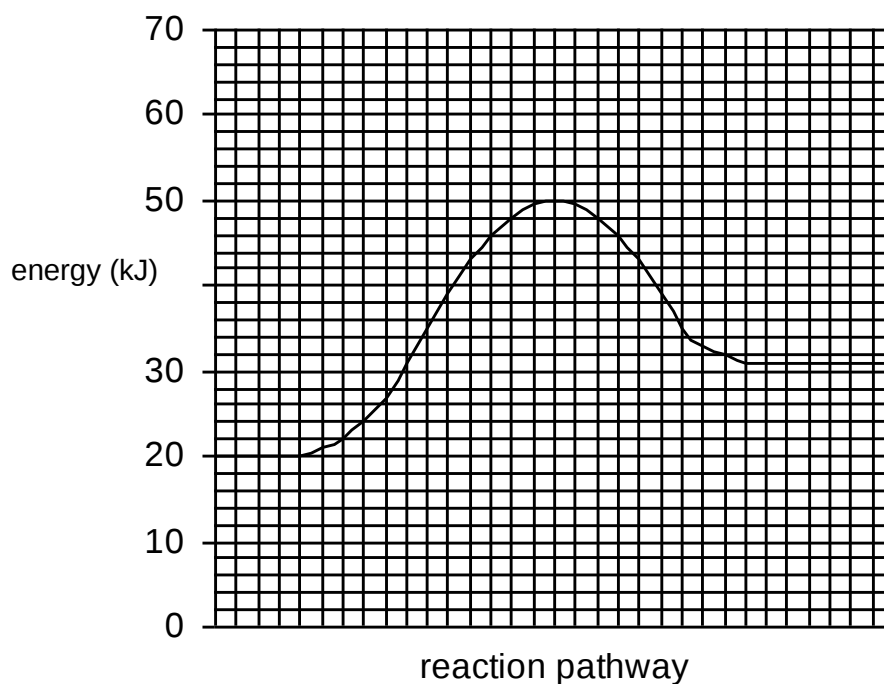
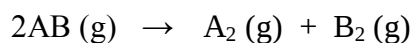
Outcomes : P10, P13, P14

9. How many oxygen atoms are present in 10.0 g of magnesium nitrate?

- (A) 0.0693
- (B) **2.4×10^{23}**
- (C) 4.17×10^{24}
- (D) 8.34×10^{24}

Outcomes : P10

10. The energy pathway for the following reaction is shown in the graph.



What is the enthalpy change for the reaction?

- (A) + 30 kJ
- (B) + 11 kJ**
- (C) - 30 kJ
- (D) - 11 kJ

Outcomes : P7

11. What is the best quantity to measure to compare activation energies for hydrocarbon combustion reactions?

- (A) ignition temperatures**
- (B) heat changes
- (C) energy released per kilogram of fuel
- (D) number of chemical bonds broken and chemical bonds formed

Outcomes : P7

12. Which of the following equations represents the complete combustion of ethane?

- (A) $\text{C}_2\text{H}_6(\text{g}) + \text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{g})$
- (B) $2\text{C}_2\text{H}_6(\text{g}) + 7\text{O}_2(\text{g}) \rightarrow 4\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{g})$**
- (C) $2\text{C}_2\text{H}_6(\text{g}) + 6\text{O}_2(\text{g}) \rightarrow 2\text{CO} + 2\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{g})$
- (D) $2\text{C}_2\text{H}_6(\text{g}) + 9/2\text{O}_2(\text{g}) \rightarrow 2\text{C} + \text{CO} + \text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{g})$

Outcomes : P9,P10

13. Which of the following statements is correct for the dissolution of sodium hydroxide?

- (A) The energy released by bond formation in ion hydration is greater than the energy absorbed by bond breaking and the dissolution is exothermic.**
- (B) The energy released by bond formation in ion hydration is greater than the energy absorbed by bond breaking and the dissolution is endothermic.
- (C) The energy released by bond formation in ionisation is greater than the energy absorbed by bond breaking and the dissolution is endothermic.
- (D) The energy released by bond formation in ion hydration is less than the energy absorbed by bond breaking and the dissolution is exothermic

Outcomes : P7

14. Which of the following affects the kinetic energy of particles?

- (A) particle size
- (B) concentration
- (C) temperature**
- (D) a catalyst

Outcomes : P7

15. Which of the following occupies the greatest volume at 25°C ?

- (A) one mole of sulfur dioxide gas
- (B) 64.0 g of oxygen gas
- (C) 53 L of nitrogen gas
- (D) 1.8×10^{24} molecules of hydrogen gas**

Outcomes : P10

Part A: Answer grid for multiple choice questions

- | | | | | |
|-----|------------------------------------|------------------------------------|------------------------------------|------------------------------------|
| 1. | A ☐ | B ☐ | C ☒ | D ☐ |
| 2. | A ☐ | B ☐ | C ☐ | D ☒ |
| 3. | A ☐ | B ☒ | C ☐ | D ☐ |
| 4. | A ☒ | B ☐ | C ☐ | D ☐ |
| 5. | A ☐ | B ☐ | C ☒ | D ☐ |
| 6. | A ☐ | B ☐ | C ☐ | D ☒ |
| 7. | A ☐ | B ☐ | C ☐ | D ☒ |
| 8. | A ☐ | B ☐ | C ☒ | D ☐ |
| 9. | A ☐ | B ☒ | C ☐ | D ☐ |
| 10. | A ☐ | B ☒ | C ☐ | D ☐ |
| 11. | A ☒ | B ☐ | C ☐ | D ☐ |
| 12. | A ☐ | B ☒ | C ☐ | D ☐ |
| 13. | A ☒ | B ☐ | C ☐ | D ☐ |
| 14. | A ☐ | B ☐ | C ☒ | D ☐ |
| 15. | A ☐ | B ☐ | C ☐ | D ☒ |

Section B 35 marks

Question 16 (7 marks)

Outcomes: P6, P13

Consider the three substances ammonia, water and hydrogen sulfide.

- (a) Construct Lewis electron dot structures for the three compounds (3 marks)

Sample answer:

$\begin{array}{c} \cdot\cdot \\ \text{H} \cdot \text{N} \cdot \text{H} \\ \cdot\cdot \\ \text{H} \end{array}$ <i>ammonia</i>	$\begin{array}{c} \cdot\cdot \\ \cdot\cdot \\ \text{O} \cdot \text{H} \\ \cdot\cdot \\ \text{H} \end{array}$ <i>water</i>	$\begin{array}{c} \cdot\cdot \\ \cdot\cdot \\ \text{S} \cdot \text{H} \\ \cdot\cdot \\ \text{H} \end{array}$ <i>hydrogen sulfide</i>
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- (b) deduce the molecular structure for ammonia (1 mark)

ammonia ...trigonal pyramidal

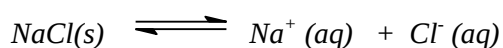
- (c) discuss the intermolecular forces that explain the melting and boiling points of the three substances(3 marks)

The magnitude of the melting points and boiling points depend on intermolecular forces between molecules .If the intermolecular forces are high, then the melting points and boiling points are high. (IF). Water and ammonia exhibit hydrogen bonding, dipole – dipole interaction and dispersion forces, whereas hydrogen sulfide only exhibit dipole - dipole interaction and weaker dispersion forces (FS). Therefore, its boiling point is lower than that of water and ammonia. The hydrogen bonding in water is much more extensive in water than in ammonia because of oxygen's higher electronegativity compared with nitrogen and the more favourable geometry of hydrogen bonded molecules in water than in ammonia. (WA)

Criteria	Mark(s)
MP and BP related to strength of intermolecular forces (IF)	1
Comparison of the different forces in the molecules (FS)	1
Comparison of extent of hydrogen bonding in water and in ammonia (WA)	1

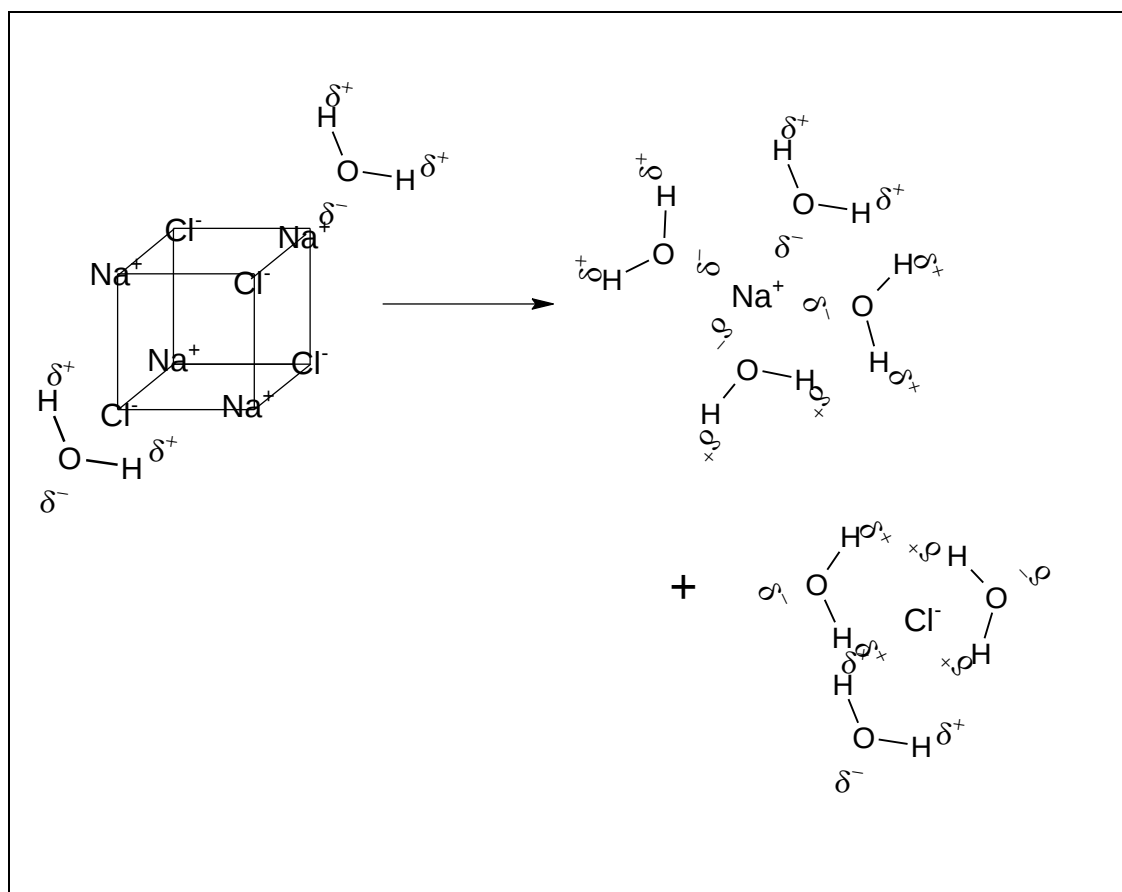
Question 17 (3 marks)**Outcomes: P6, P13****Sample answers**

- (a) Use an ionic equation to show the dissolution of sodium chloride in water to form a saturated solution. (1 mark)



Criteria	Mark(s)
correct equation	1

- (b) Draw a very clear diagram to show how sodium chloride interacts with water resulting in its dissolution (2 marks)



Criteria	Mark(s)
correct orientation of oxygen and hydrogen of water interacting with sodium ion and chloride ion	1
correct equation	1

Question 18 (5 marks)**Outcomes:**P8, P10, P13**Sample answer**

0.534 g of CaCl_2 was dissolved in enough water to make a 500.0 mL solution.

(a) What is the concentration of CaCl_2 in the solution

(i) in ppm? (1 mark)

$$\begin{aligned} \text{Ca in ppm} &= \frac{\text{mass CaCl}_2 \times 1000 \text{ mg/g}}{L} = \frac{0.534 \times 1000 \text{ mg/L}}{0.500 L} \\ &= 1068 \text{ mg/L} = 1068 \text{ ppm} \end{aligned}$$

Criteria	Mark(s)
correct calculation of ppm	1

(ii) in mol L^{-1} ? (2 marks)

$$[\text{Ca}^{2+}] = \frac{\text{mass CaCl}_2}{M_{\text{CaCl}_2} \times \text{Vol L}} = \frac{0.534}{40.08 + 2(35.45)} / 0.500 L = 9.62 \times 10^{-3} \text{ mol L}^{-1}$$

Criteria	Mark(s)
correct equation to calculate moles CaCl_2	1
use of correct volume (0.500L) to calculate molarity	1

(b) What is the concentration of Cl^- in % (w/v) (3 marks)

$$[\text{Cl}^-] = 2 \times 9.62 \times 10^{-3} \text{ mol L}^{-1} \quad (1 \text{ mark})$$

$$\begin{aligned} \text{mass Cl} &= C \times V \times \text{atomic mass Cl} \\ &= 9.62 \times 10^{-3} \text{ mol L}^{-1} \times 35.45 \text{ g/mol} = 0.341 \text{ g/L} \quad (1 \text{ mark}) \end{aligned}$$

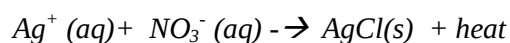
$$\% (\text{w/v}) = \frac{0.341 \text{ g}}{L \times 1000 \text{ mL/L}} \times 100 = 0.0341 \% \quad (1 \text{ mark})$$

Outcomes:P8, P10, P13

Question 19 (5 marks)**Outcomes:P8, P10, P13***Sample answers*

When 10.0 mL of a 0.020 mol L⁻¹ BaCl₂ solution is added to 50.0 mL of a 0.020 mol L⁻¹ of AgNO₃ solution, a white precipitate is formed.

- (a) Write a net ionic equation for this exothermic reaction.
(1marks)



Criteria	Mark(s)
correct equation	1

- (b) What mass (in grams) of precipitate is formed? (4 marks)

$$\text{moles BaCl}_2 = c \times V = 0.02 \text{ mol L}^{-1} \times 0.010 \text{ L} = 2.00 \times 10^{-4} \text{ mole (1 mark)}$$

$$\text{moles AgNO}_3 = c \times V = 0.02 \text{ mol L}^{-1} \times 0.050 \text{ L} = 1.00 \times 10^{-3} \text{ mole (1 mark)}$$

$$\text{moles AgCl} = 2 \times \text{moles BaCl}_2 = 2 \times 2.00 \times 10^{-4} \text{ mole} = 4.00 \times 10^{-4} \text{ mole (1 mark)}$$

$$\text{Mass AgCl} = \text{moles AgCl} \times M \text{ silver chloride (1 mark)}$$

$$= 4.00 \times 10^{-4} \text{ mole} \times (107.9 + 35.45)$$

$$= 0.057 \text{ g}$$

Question 20 (5 marks)

You performed a first hand investigation to observe the change in reaction rate of a chemical reaction by changing the temperature.

- (a) Outline the procedure used and the results obtained. (3 marks)

Sample Answer

We mixed two chemicals together, in a conical flask, that formed a precipitate. We put the conical flask in a water bath of varying temperatures. We performed the experiment 5 times with 5 different temperatures in the water bath. The water bath temperatures ranged from 10 degrees to 60 degrees. There was a cross on the bottom of the flask. We recorded the time it took for enough precipitate to form to obscure the cross on the bottom of the flask. As the temperature of the water increased, the reaction got faster and the cross was obscured more quickly.

Marking Criteria	Mark(s)
Outlines a valid procedure and results obtained	3
Outlines a valid procedure but gives no results OR Identifies a procedure and results obtained	2
Brief procedure OR Correctly identifies results obtained	1

Outcomes:P8

- (b) Identify a risk associated with this procedure and explain the step(s) taken to reduce the risk identified. (2 marks)

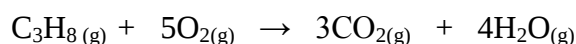
Wear safety goggles to reduce the risk of chemicals being splashed in to the eyes.

Marking Criteria	Mark(s)
Identifies a risk in the given procedure and gives a strategy to reduce the risk.	2
Identifies a risk in the given procedure	1

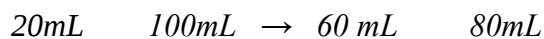
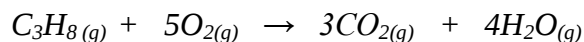
Outcomes:P7,P8**Question 21** (5 marks)

40 mL of propane (C₃H₈) was mixed with 100 mL oxygen and ignited at 200⁰C. When combustion was complete, it was found that all the oxygen had been used and 20 mL of propane was left.

- (a) Write an equation for this reaction.(1 mark)



- (b) Calculate the volumes of the gases produced in the final gas mixture. (2 marks)



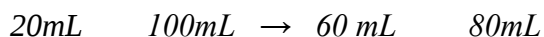
60mL CO₂ and 80mL of H₂O

Marking Criteria	Mark(s)
Correct volumes of the product gases	2
One correct volume	1

- (c) Show that these results are consistent with Gay Lussac's Law of combining volumes.
(2 marks)

Sample answer

The reactant and product gases are in simple whole number ratios.



1 : 5: 3: 4

Marking Criteria	Mark(s)
States Guy Lussacs' law and shows the ratios	2
Shows the ratios	1

Outcomes:P10,P9

Question 22 (3 marks)

Identify an industrial catalyst and describe the role it has in a chemical reaction.

Sample answer

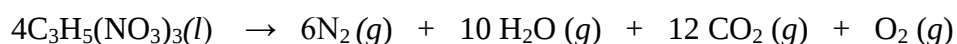
V₂O₅ is a catalyst used in the Contact Process in the production of sulfuric acid. It is used to lower the activation energy required so the reaction can proceed at a lower temperature and ends up being faster.

<i>Marking Criteria</i>	<i>Mark(s)</i>
Identifies an industrial catalyst and describes the role of a catalyst	3
Identifies an industrial catalyst and outlines the role of a catalyst	2
Identifies an industrial catalyst Or identifies the role of a catalyst	1

Outcomes:P8

Question 23 (3 marks)

Nitroglycerine C₃H₅(NO₃)₃(l) is used as an explosive and undergoes the following decomposition reaction.



- (a) Calculate the molar mass of *one* mole of nitroglycerine. (1 mark)

371g

- (b) How many moles of gas would be produced by the decomposition of *two* moles of nitroglycerine at 25⁰ C? (1 mark)

14.5 moles

- (c) What volume of gas would be released by the decomposition of *four* moles of nitroglycerine at 25⁰ C? (1 mark)

29 x 24.79 = 718.91L

Outcomes:P10,P7